An Ising-model game using LEGOs based on species evolution
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Interpretation: Marine plants grow up from the base level of an Ising lattice, physically based on a planar LEGO piece representing the bottom of the ocean. As the plants grow higher up, they attain different levels; each higher level being nearer the source of light energy and thus conferring higher abilities to grow/move/replicate than the levels below them.

1. Rules of Accounting

A. Before game play is started, various variables or decisions are decided by the players. These variables are listed in red, e.g. A These variables will be listed sequentially as they arise in the description of the game.

B. Levels, L, are defined as sets of heights above the base level, which represents the ocean floor. Levels are actually 2-dimensional vectors of entries in Natural numbers; L = L {number of total levels, height of levels above the preceding one}: L = L(t,h) Levels are used to inject variety into other variables.

*For example, Level 1 might consist of the plane three units above the base level. Representing being lower down in the ocean and therefore receiving little light, all organism would only be able to grow one unit in height per turn. And none would be able to replicate at that level.

*For example, in addition to the requirements of Level 1 preceding, Level 2 might consist of the plane 4 units above Level 1, allowing 2 units of vertical growth per turn, and 2 replications at the ocean floor per turn.

C. The game is played in turns, where each player's species grows/moves/replicates according to specified rules.

D. The winning species is defined as:

1. that species which out-produces or blocks-out the area, of all the other species.

*For example, species A could grow faster than species B and simple occupy the greater number of base points on the ocean floor; W = "ocean floor occupation" winning option.

*For example, species A could occupy the greater number of area points at the highest level than species B; W = "ocean surface occupation" winning option.

2. that species which out lasts all other species over time T, given the existence of additional parameter of death/predation, D.

*For example, species A and B have given death rate D = D(level), for each level. This rate can be interpreted as a maximum life span or a rate of predation. (In fact, the death rates could be different for each species, which would obviously add another variable, but that variation is not considered here.) In that case, that species wins which has the greatest number of ocean floor or ocean surface area, depending on option W.

*For example, T = "specified number of moves option" where the option is a Counting Number.

*For example, T = "establishing an equilibrium system option" where that species wins which can first establish a distinct area on the ocean floor or surface where the growth rate equals the death rate.

So far, the definition of winning involves 2 options: W = {ocean floor occupation, ocean surface occupation}; or D = {death rate from 0 to specified percentage at each level} AND T = {number of moves, first equilibrium in a given area}.

NB: As it is currently stated, for T = first equilibrium option, if the maximum growth rate (see below) were larger than D, a player could play the birth rate at a given level to equal D, and thus achieve an equilibrium. To preclude this amount of arbitrary player control, the T = first equilibrium option would have to also include a requirement that requires the winning player to, for example, have the *larger* sustainable area instead of the *first*, or for example, to require that the winning player's sustainable area be so where the maximum birth rate at the level W, equals D.

2. Rules of Growth

   A. Growth is defined as movement up from the ocean floor or up from preexisting species individuals. Initial singles and their placements on the ocean floor for each side will be determined beforehand by agreement of each player. Various densities—the minimum distance between initial singles on the ocean floor might yield some interesting results as the game progresses.

   B. Single blocks, singles, are 1x1 blocks. Only single blocks can be used to start from the ocean floor. Double blocks, doubles, are 1x2, that is 1 up and two in any acceptable horizontal direction. Double blocks can only be added at levels > 1. One may also, upon agreement between the opponents before the start of the game, to use triples. The total number of singles, doubles, and triples should also be agreed upon before the game starts and they should usually be equal for each opponents. Differences in these might, however, prove interesting as the game progresses.

   C. Growth consists of two options: up G1 units of single blocks and G2 units of double blocks. That is, one can choose either single blocks or double blocks. This choice could be restricted to one species with the alternate choice going to the other; this would, depending on the definition of "wining" demonstrate success differences between species.

   D. Growth is dependent on the level, Gx = Gx(Level), where x = {1,2}. For example, a species can grow up, 1 unit of singles per turn in Level 1, up 2 units of singles per turn in level 2, etc. and up 0 units of doubles per turn in Level 1, up 1 unit of double in level 2, etc.

3. Rules of Movement.

   A. Movement is defined as adding a double onto an existing organism. It is defined as a special condition in order to provide orderly growth.

   B. As such, movement is a subset of growth, and it does not introduce another variable. It is a description for the spread of organisms in different horizontal directions that do not constitute replication, which latter is starting from the ocean floor. Movement is a form of budding.

   C. If an organism of species A moves over an organism of species B, the growth of the species B organism is stopped, unless it itself moves.

D. No organism can replicate under the bud of another organism, regardless of species.

E. Movement can can extend only to an adjacent vertical or horizontal site

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* →   * * *
        *
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where → means that * goes in the next turn to * and *one* of the black *, using a double.

NB: For mechanical reasons, this "quadrature" option is used instead of the "any adjacent" option is nearly always chosen since the diagonals of the octature would stretch the doubles and create disorderly, non-rectangular, patterns growth.

4. Rules of Replication

A. Replication is defined as adding R, (a Natural number) singles (the only one permitted) per species per turn to the base plane. Only single can be started on the base plane, the ocean floor.

B. An additional variable, E, is involved in replication and codifies the distance from the base of existing organisms of the species that at new organism of the that species can start.

Additional rules may be necessary for smooth play. While the play is currently represented on a lattice of LEGOs, the game fairly begs to be realized on a computer. The game can be played on a family of matrices, one for each level.

The picture below is an example of a game that started with 5 single initial organisms of each player on the ocean floor. The white area encloses an area where no organism can neither begin nor encroach over. Both sides have blocked either vertically or horizontally. The organisms have both achieved a end state of six levels and the game is over.